

# The optimised aluminium foundry: zero waste, zero defect



Everything you need, for every part of the process



## Understanding how equipment, innovative services and digital solutions can be used to improve, and connectedly advance, operations is the foundation of your business.

Get it right and the opportunity to improve productivity and gain competitive advantage, even during times of uncertainty, is there for the taking. This comprehensive guide is about 'getting it right'.

It is designed to help aluminium die casting foundries flourish by looking at how different technologies and solutions can be used individually and together to optimise production at every stage to eliminate waste, improve quality and maximize efficiency through seamless integration. Welcome to Norican's complete Aluminium Foundry.

### **The aluminium opportunity**

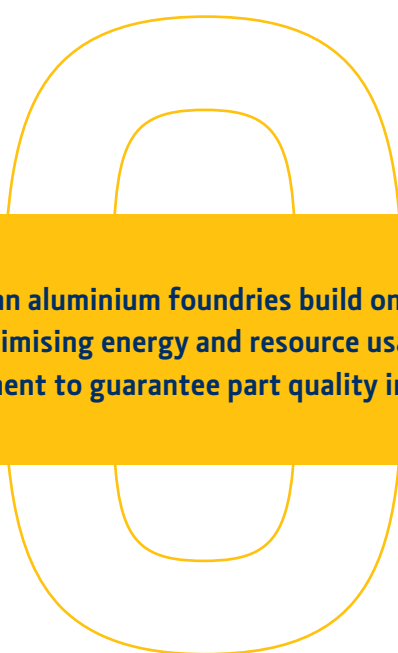
Mega trends, from lightweighting in automotive, the rise of e-mobility, and advances in 5G technology, to growing societal demands for improved recyclability and widespread rejection of plastics, have all set a global sustainability backdrop which has seen aluminium usage soar.

#### **Sustainable advantage: recyclability and waste reduction**

A fundamental reason for the growth in aluminium usage is its advantage over other materials in terms of recyclability and waste reduction. Near net shape production requires less machining and wastes less material – the properties (including malleability) of aluminium are particularly suited to leveraging this benefit for improved raw material efficiency.

#### **Die casting challenges: resource and energy intense**

Aluminium die casting operations are highly resource and energy-intensive. Approximately 25% of the total cost of die cast parts are associated with energy consumption. This is a sustainability (and economic) issue we have to address, with 24-hour furnace running costs a key factor. The high melting temperatures associated with metals like aluminium, say over zinc, also impact on production time and operational safety.



**So how can aluminium foundries build on this potential for material efficiency while minimising energy and resource usage, all while implementing continuous improvement to guarantee part quality in a competitive market?**

## **Zero defect: waste less, make more**

The answer to this difficult balancing act is 'zero'. This doesn't mean do nothing. It means focussing on a zero waste (resource and energy), zero defect strategy. Because, thanks to evolving equipment capabilities and emerging digital solutions, the two can go hand in hand.

It's also a strategy which, if adopted, naturally addresses other key challenges in a rapidly evolving aluminium market:

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### **1 Increased demand for large, complex structural aluminium parts**

Complex structural parts must be 'zero defect' to meet higher mechanical performance requirements, combining great strength and rigidity with the lowest possible weight. But they also pose practical challenges. For example, having to manually cut pieces down to re-melt in order to fit in your furnace may waste time and human resource. Addressing this was one of the key drivers behind StrikoWestofen's BigStruc – a melting furnace specifically for structural parts.

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### **2 Shorter development cycles and rapid technology shifts**

These two factors mean that new foundry lines often go from the drawing board to production much more quickly making any waste (inefficiency) a stumbling block. Meanwhile, anything that could cause delays in the supply chain, including quality issues detected too far down the line, has to be identified and addressed to maximise efficiency.

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### **3 Sustainable production**

There's more to sustainable production than slashing energy consumption and costs. Sustainable production also means eliminating factors which threaten long-term production – unplanned and unnecessary downtime falls into this category. Foundries need to focus on zero waste solutions that optimise uptime and get production right first time.

At Norican and across our four technology brands – StrikoWestofen, Italpresse Gauss, DISA and Wheelabrator - we take a full-process view from melting to cleaning, to develop innovations and solutions that help customers achieve zero waste and zero defect ambitions and tackle these challenges.

# Continuous improvement - from furnace to finished casting

Leveraging the right equipment and digital solutions can make a huge difference to the efficiency and efficacy of operations. Here is a quick tour of the aluminium foundry floor to highlight the improvements possible and how to achieve them.

## 1 Melting and dosing

### Eliminating energy and metal waste: optimised furnace efficiency

Melting aluminium is extremely energy intensive. The melt-shop alone can account for as much as 77% of the overall energy consumption in a die casting foundry.

It is also a process prone to metal loss. Depending on the aluminium alloy in question, a metal loss of just 1% of an annual melting output of 5,000 metric tons leads to a financial loss of approximately 70,000 EUR.

Adopting more energy efficient technologies, automated systems which make production more agile and less reliant on manual intervention, and solutions specially designed to maximize metal yield, therefore offers a significant opportunity to save huge amounts of energy and money.



With a lowest measured energy consumption of just 489 kWh/t and a near 100% metal yield (99.75) for improved quality, StrikoMelter is the most efficient melting furnace on the market. StrikoWestofen's Part Load Efficiency Control boosts melting process efficiency – especially during low utilization – by optimizing melting and holding over longer periods, reducing energy consumption by up to 20%. Together these two solutions help customers save money, time and make more of their resources.

Monitizer | Refill Monitor: This digital solution from StrikoWestofen uses real time sensor-generated data

to ensure aluminium dosing furnaces never run dry and only ever receive the right alloy at the right time. This prevents unnecessary filling runs, avoidable stoppages and guarantees that dosing and bale-out equipment is always working at full capacity.

Productivity of metal supply increases by up to 15% and, on average, an overall productivity increase of between 0.5% -1% is achieved thanks to reducing downtime and optimized filling cycles. More uptime, more accuracy, more profitable production.

## Dosing you can depend on: swapping risk for reliability

The next task is to mitigate risks that may occur during the dosing process itself. There are many factors which can hamper this important stage.

For example, delivering 'high quality aluminium' can be put at risk by oxides entering the melt during the dosing process – a common issue with pump-based systems. This can lead to metal loss and undesirable scrap rates. As can temperature fluctuations. Even slight variations can impact melt flow characteristics, dosing precision and mould filling.

Selecting a ladle-free (crucible-free) pressure-controlled riser tube-based dosing furnace which takes liquid metal from below the bath surface helps avoid the risk of metal contamination and the associated quality implications, while also saving energy.

StrikoWestofen's Westomat crucible-free dosing furnace uses just one-third of the energy required by a classic ladle system, limits metal loss to just 0.06%, eliminates temperature fluctuations and has a 98% availability rate due to minimal maintenance requirements and durability.

## 2 Aluminium casting

### Optimised die casting: bigger, smarter, leaner

Zero waste, zero defect isn't just a mantra with melt shop benefits. In order to cope with the new wave of larger, often more complex structural parts in high demand, High Pressure Die Casting (HPDC) machines with greater closing forces are necessary, ranging from 3,500 tonnes to 5,700 tonnes. The problem is, if additional space is required to accommodate these giants, it can impact on production flow/capacity; wasted space can effectively equate to lost potential.

Also, such machines need to have extremely tight die closures in order to eliminate scrap and avoidable flash for high-quality part repeatability (zero defect).



Italpresse Gauss offers deliberately compact, digitally enabled toggle-free HPDC machines with rigid, tight, closing units and a range of clamping forces from 1000 to 5700 tonnes – delivering the advantage of greater force and larger platens, without taking up additional space on the foundry floor



## Consider fully automated cells

Saving precious space while boosting productivity and production flexibility is also desirable to cope with the sheer diversity of parts now sought in aluminium. It's a challenge well-met by fully automated solutions employing high pressure, low pressure and gravity die casting technologies.

As well as tightly coupling the dosing, injection and casting extraction process, casting cell automation can be extended to handle ancillary tasks like metal pouring, die lube spraying, liner insertion, part extraction and marking – all depending on specific needs.

Together with the opportunities presented by sophisticated digital monitoring and process optimising solutions (see Section 4) this end-to-end approach can make aluminium die casting faster while at the same time eliminating scope for error.

Italpresse Gauss' automated work cells are designed to optimise cycle time and stability for improved quality casting with less energy wastage, and to seamlessly integrate periphery equipment such as StrikoWestofen's Westomat dosing furnace.



## Getting to grips with green sand for aluminium

It's not just die-casting foundries that can benefit from a zero waste, zero defect approach to aluminium casting. A wealth of opportunities are available to green sand foundries seeking to streamline their operations.

For advice on optimising aluminium green sand casting, whether using gravity pouring or low pressure pouring and whatever your production volume and velocity, visit [www.disagroup.com/en-gb/castings-by-alloy/aluminium](http://www.disagroup.com/en-gb/castings-by-alloy/aluminium) to see how



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## Surface preparation

### Shot blasting aluminium

Surface preparation and cleaning operations are not always front of mind when looking for areas for improvement in aluminium die casting operations. But why let your perfect process down on the final stretch? Especially when there are more zero waste, zero defect benefits to be achieved.

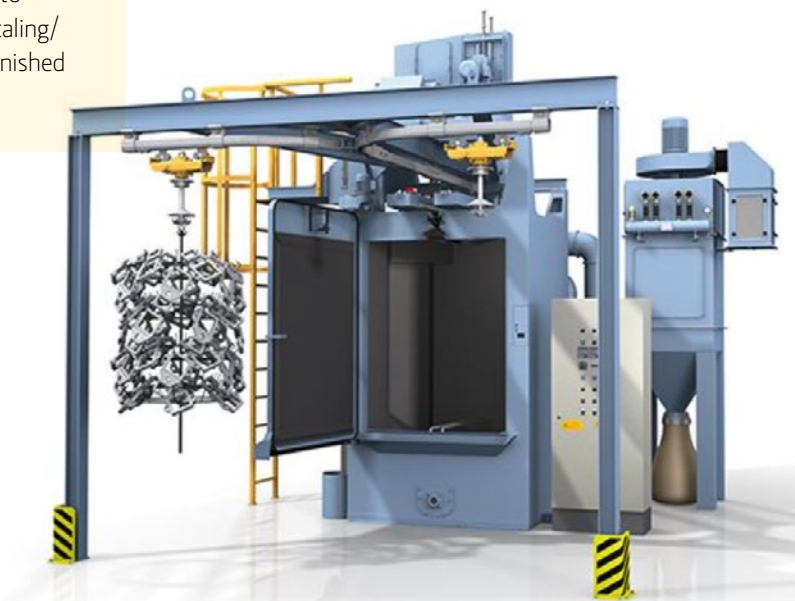


### Light, lean and capable of dealing with complexity

Aluminium production settings demand lighter, more flexible and more compact shot blast equipment. Solutions adopted should be specifically designed to efficiently clean large, structural aluminium castings that may have complex internal surfaces. Lightweight aluminium parts can also have thin wall thicknesses making them susceptible to deformation, so whether you use an air or wheel blast process, precise control is essential to avoid damage.

Wheelabrator's blast machines for aluminium integrate into tight cell layouts to provide compact, seamless material and workpiece handling, with flexible construction that allows equipment to be moved and adapted quickly to suit rapidly changing production requirements.

Space is maximized, downtime is minimized, and - thanks to innovative engineering tailored for precision blasting, descaling/ deburring, deflashing and cleaning of aluminium parts - finished part quality is optimised.



# Digital transformation for die casting

Double-digit productivity increases

**Industry 4.0 and IIoT technologies offer a fresh opportunity to collect and synchronise data from multiple sources in order to achieve a complete view of foundry operations, and subsequently orchestrate foundry processes to work in perfect harmony to supercharge productivity.**

In fact, consultants McKinsey report, that taking a foundry-wide digital view can deliver double-digit productivity increases. What's even better news is that adopting such technologies doesn't have to be difficult. In fact, 'doing more with data' is an option open to all aluminium foundries, whatever the existing set-up and digital infrastructure.

## **Ready and (digitally) able**

Most new pieces of foundry equipment – from furnaces and die casting machines to surface finishing equipment – now leave the

factory floor digitally enabled i.e. ready to connect to peripheral equipment and data monitoring solutions.

Those that aren't can have their data sharing potential unlocked by using 'gateway' technology, such as our own NoriGate solution, which enables any machine to be "IIoT enabled" to deliver better quality of data. Without having to invest in any new machines, aluminium foundries all have the opportunity to collect process data from any local machines and sensors. The foundation of any data journey.





### On site or multi-site monitoring

Using the data collected aluminium foundries can then visualise and analyse the data to gain a real time understanding of vital processes and key performance levels – making comparisons between different machines, casting cells, and foundry sites, possible. It also makes informed decision making for intervening and implementing improvements, practical.

NoriGate technology and our **Monitizer** cloud-based solutions, mean that real time data from every element of your aluminium operations (whether from a single foundry or a network of sites) can be centrally analysed and measured against KPIs set by you, from any location. In other words, the right people will have the right information they need to make the right decisions at any given moment.



### Automating improvements that drive up profitability

With AI-enabled analytics and automated process control solutions, aluminium foundries also have the ability to take their digital journey one step further. Such solutions enable real-time, continuous monitoring and automatic process corrections to take place before potential issues have a chance to develop. In other words, the whole aluminium casting process can be continually optimised for maintaining high quality standard and productivity levels.

**Monitizer® | PRESCRIBE** harnesses the power of Artificial Intelligence to optimise your **entire foundry process** to reduce scrap and increase profit. It finds the set-up that delivers the highest yield and most stable production, then keeps your whole line in that “sweet spot” with real-time advice on process parameters.

**Digital tools like this are here to help aluminium foundries eliminate defects, dramatically cut scrap and minimize downtime. All thanks to the one thing all foundries already have in abundance. Data. It's just a matter of unlocking its full potential.**